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Systematic Study of Larvae of North American Alticinae (Coleoptera: Chrysomelidae) by Larval Characters Part I. Genus *Altica* from North America

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ABSTRACT

The present paper is a part of the studies on the larvae of subfamily Alticinae in North America. Eight species were described and illustrated belonging to genus *Altica* in the subfamily Alticinae: *Altica ambiens alni*, *A. bimarginata*, *A. brisleyi*, *A. litigata*, *A. potentillae*, *A. sylvia*, *A. torquata* and *A. ulmi*. It is the first to deal the larvae taxonomically in North America. Their key and taxonomic remarks are also given.

Key words: Larva, *Altica*, Alticinae, Chrysomelidae, Coleoptera, North America

INTRODUCTION

Alticine larvae including many forest and agricultural pest were studied by many workers from the morphological and biological aspects. Ogloblin and Medvedev (1971) Kimoto and Takizawa (1994) and Steinhausen (1994) studied many genera of alticine larvae taxonomically using by the characters of pysidial shield and chaetotaxy. And some miscellaneous works by many other workers (Reed, 1927; Boving and Craighead, 1931; Newton, 1933; Dobson, 1960; Yano, 1963, 1965; Welch 1972; Steinhausen, 1994; Lee, 1992, 1999a, b; Lee *et al.*, 1998; Furth and Lee,

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2000 etc.). Despite the contributions of these researchers, detailed larval morphology of North American *Altica* has heretofore remained undescribed except for Paterson (1943) and Lee and Furth (2000).

The present authors describe and illustrate the mature altcine larvae belonging to Alticinae collected North America; *Altica ambiens alni, A. bimarginata, A. brisleyi, A. litigata, A. potentillae, A. sylvia, A. torquata* and *A. ulmi*.

The present paper is aimed to provide detailed descriptions of the eight species of genus *Altica* from North America as the basic data for the systematic study of the subfamily Alticinae.

MATERIALS AND METHODS

The mature larvae used in this study are stored in 70% ethyl alcohol at the Smithsonian Institution. The method of slide preparation follows LeSage (1984). The larvae were dissected using a dissecting microscope (Olympus SZH). A compound microscope (Leitz Wetzlar) with a camera lucida attachment, was used to illustrate all structures. The terminology of tubercles essentially follows Anderson (1947) and Kimoto (1962).

SYSTEMATICS

Key to the known species of *Altica* larvae from North America

1. Tubercle with club-shaped setae 2
– Tubercle without club-shaped setae 3
2. Club-shaped setae on dorsal tubercle ..... *A. brisleyi*
– Club-shaped setae on only anal plate ..... *A. torquata*
3. Mandible with penicillus 4
– Mandible without penicillus 6
4. Mandible gouge-form; mandible with 4 teeth ..... *A. potentilla*
– Mandible palmate-form; mandible with 4 teeth 5
5. Labrum with 2 pairs of labral setae ..... *A. sylvia*
– Labrum with 3 pairs of labral setae ..... *A. ulmi*
6. Frons with 2 pairs of frontal setae 7
– Frons with 4 pairs of frontal setae ..... *A. litigata*
7. Clypeus with 1 pair of clypeal setae ..... *A. ambiens alni*
– Clypeus with 3 pair of clypeal setae ..... *A. bimarginata*

Genus *Altica* Geoffroy, 1762

1. *Altica ambiens* alni Harris, 1869 (Fig. 1)

Body dark brown, nearly flattened, slightly slender and long, thoracic segments slightly convexed. Head, tubercles, anal plate dark brown.

Head. Hypognathous, rounded, strongly sclerotized; epicranial suture well developed, V-shaped;

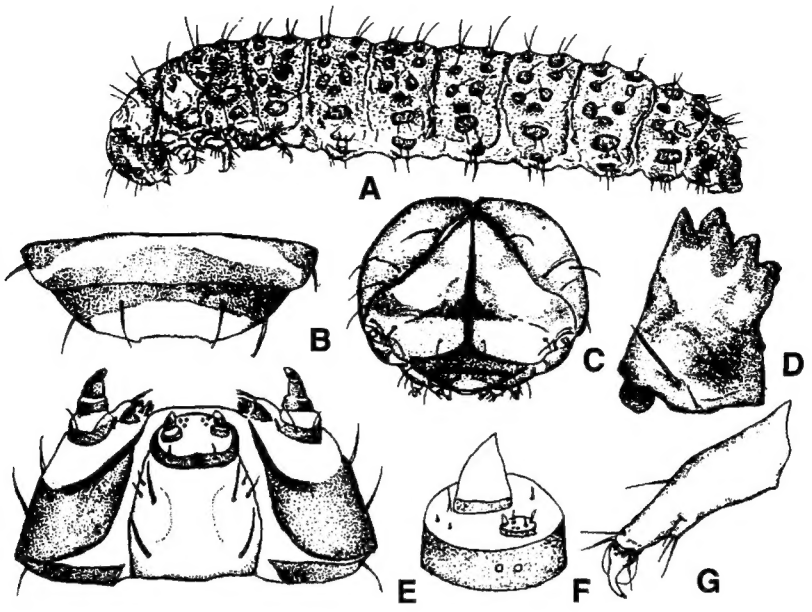

Fig. 1. *Altica ambiens alni*. A, mature larva; B, clypeus, labrum and epipharynx; C, head; D, mandible; E, lower mouth parts; F, antenna; G, leg.

coronal suture very short; frontal suture moderately divergent (40°), somewhat curved at lateral. Stemmata absent. Frons subtriangular, with 2 pairs of frontal setae and 1 pair of sensilla; endocarina distinct for full length; epistomal suture developed. Antenna 2-segmented; segments 1 with 2 sensilla and 4 setae; a large conical sensory papilla, segment 2 with 4 setae and 2 sensilla. Clypeus trapeziform, well developed, with 1 pair of clypeal setae and 2 pairs of clypeal sensilla. Labrum notched at anterior, with 2 pairs of setae and 1 pair of sensilla. Epipharynx not developed. Mandible palmate form, 4 distal teeth, 2 mandibular setae and 1 sensilla; penicillus absent. Maxillary palp 3 segmented; palpifer with 3 setae; stipes with 2 setae. Galea with 4 setae; lacinia with 5 setae; cardo with 1 seta. Labial palp 2-segmented; prementum with 1 pair of setae, with 3 pairs of sensilla; postmentum with 4 pairs of setae.

Thorax. Pronotum dark brown, strongly sclerotized, with 8 pairs of setae. Mesothoracic spiracle annuliform, situated on EPa part; peritreme darker than adjacent cuticle. Legs rather long and slender, tibia with 3 pairs of setae, claw falciform, moderately curved at anteriorly, tip point and base enlarged; with 1 seta, pulvillus bladder-like.

Abdomen. Ten segmented; abdominal spiracles present on segments 1-8 similar to mesothoracic spiracles but smaller. Pygopod well developed, anal plate with 5 pairs of setae.

Body length : 8.0 mm (n = 5). Head width : 1.1 mm (n = 5).

Material examined. Rhinelander, Wisconsin. H. J. Aloney, 11 Aug. 1938, larvae collected on the leaves of host plant.

Remarks. The larvae of this species are closely related to *A. bimarginata*, but different by the following characters: prementum with 3 pairs of premental sensilla, clypeus with 1 pair of clypeal

setae and 2 pairs of sensilla.

2. *Altica bimarginata* Say, 1824 (Fig. 2)

Body nearly flattened, slender and long. Body deeply pigmented. Head, tubercles, anal plate well developed and sclerotized. Dorsal tubercle with numerous setae.

Head. Hypognathous, rounded, strongly sclerotized; epicranial suture well developed, Y-shaped; hind corners of epicranium slightly produced posteriorly; coronal suture 1/7 width of head capsul; frontal suture neraly straight but curved at the middle; moderately divergent (35°). Frons subtriangular, with 2 pairs of setae and 1 pair of sensilla; endocarina distinct for full length. Antenna 2-segmented; segment 1 with 1 seta and 2 sensilla; a conical sensory papilla well developed, segment 2 with 4 setae. Clypeus trapeziform, with 3 pairs of clypeal setae. Labrum somwhat incised in the middle of anterior, with 2 pairs of setae and 1 pair of sensilla, Epipharynx with 9 pairs of spiniform setae, well developed, densely covered with spinules. Mandible strongly sclerotized, palmate form, 4 distal teeth, 2 mandibular setae and 1 sensilla; penicillus absent. Maxillary palp 3 segmented; palpifer with 2 setae; stipes with 2 setae. Galea with 4 setae; lacinia with 9 setae; cardo small, with 1 seta. Labial palp 2-segmented. Prementum with 3 pairs of setae and 3 pairs of sensilla; postmentum with 4 pairs of setae.

Thorax. Pronotum strongly sclerotized, with 8 pairs of setae. Thoracic spiracles rounded, uniformus, legs rather long and slender, tibia with 5 setae, claw with 1 seta; pulvillus present.

Abdomen. Ten segmented; abdominal spiracles present on segments 1-8 similar to mesothoracic

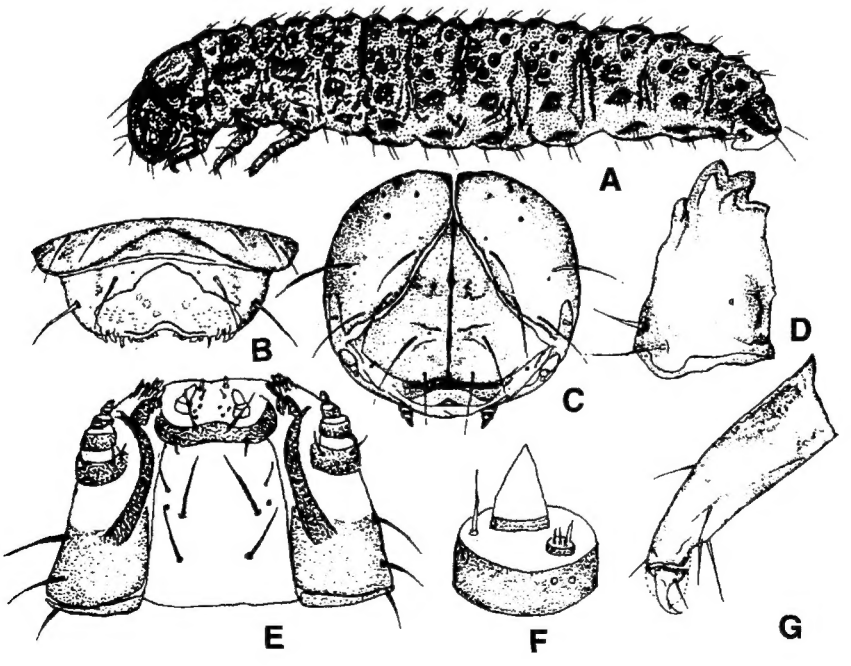

Fig. 2. *Altica bimarginata*. A, mature larva; B, clypeus, labrum and epipharynx; C, head; D, mandible; E, lower mouth parts; F, antenna; G, leg.

spiracles but smaller. Anal plate with strongly developed 7 pairs of setae.

Body length : 7.7 mm (n = 5). Head width : 0.7 mm (n = 5).

Material examined. Three Rivs. California, 18 June 1926, larva collected on Alnus sp. (Hopk.U.S 10651).

Remarks. The larvae of this species are closely related to *A. ambiens alni*, but different by the following characters: clypeus with 3 pairs of clypeal setae, epipharynx with 9 pairs of well developed spiniform setae and covered with spinules.

3. *Altica brisleyi* Gentner, 1928 (Fig. 3)

Body slightly convexed, dorso-ventrally. Head, tubercles, legs, anal plate sclerotized, pale brown. Dorsal tubercles with club-shaped seate.

Head. Hypognathous, rounded, strongly sclerotized; epicranial suture well developed, v-shaped; hind corners of epicranium somewhat produced posteriorly; coronal suture about 1/8 width of head; frontal suture straight (40°), slightly curved at laterally. Stemmata absent. Epicranium with 4 pairs of developed epicranial setae and 5 pairs of lateral setae. Frons triangular, with 3 pairs of setae; endocarina distinct for full length; epistomal suture developed. Antenna 2-segmented; segment 1 with 4 setae and 2 sensilla, a conical sensory papilla, segment 2 with 3 setae(one spin-like seta). Clypeus bright, with 1 pair of setae and 2 pairs of sensilla; labrum slightly darkbrown, slightly incised in the middle of anterior, with 2 pairs of setae and 1 pair of sensilla; epipharynx with 4 pairs of spine-like setae and serval pairs of spinules. Mandible palmate, somewhat

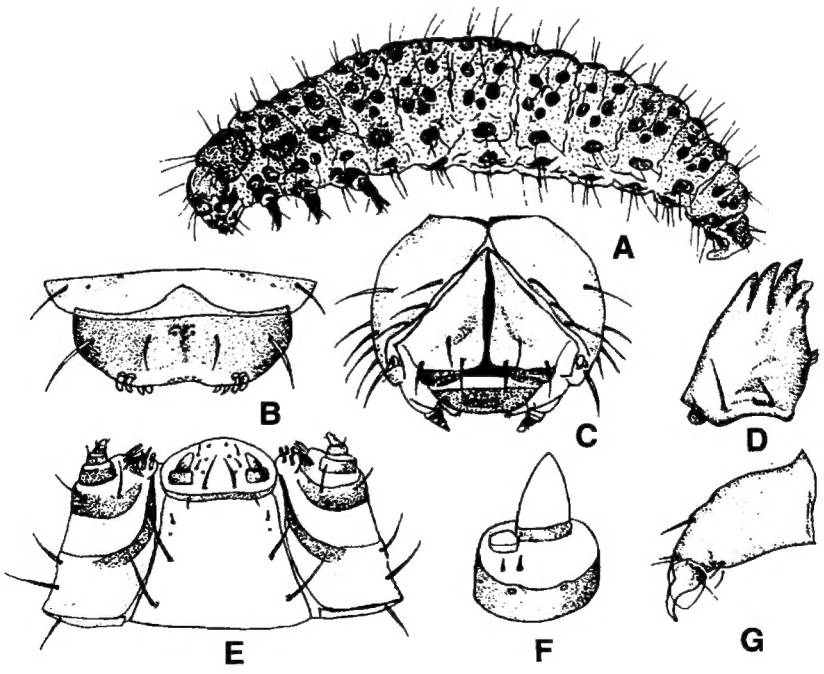

Fig. 3. *Altica brisleyi*. A, mature larva; B, clypeus, labrum and epipharynx; C, head; D, mandible; E, lower mouth parts; F, antenna; G, leg.

sclerotized, 5 distal teeth, the third slightly fused with fourth, 2 mandibular setae; penicillus present. Maxillary palp 3 segmented; palpifer with 2 setae; stipes with 2 setae; Galea with 5 pairs of setae; lacinia with 4 pairs of setae; cardo samll, with 1 seta. Labial palp 2-segmented. Pprementum with 3 pairs of setae and 3 pairs of sensilla, postmentum with 4 piars of setae and 1 pair of sensilla.

Thorax. Pronotum slightly sclerotized, with 8 pairs of thickly developed setae and 3 pairs of sensilla. Thoracic spiracles rounded. uniforous. Legs rather fatty and short, tibia with 6 setae, claw hook-shaped tip point and base enlarged; pulvillus present.

Abdomen. Ten segmented; abdominal spiracles present on segments 1-8. Anal plate with 5 paris of club-shaped setae and two pairs of sensilla.

Body length : 4.0 mm (n = 5). Head width : 0.4 mm (n = 5).

Material examined. Presidio Texas, J.H. Rnssel 23 Aug. 1943, larvae collected foliage native vegetation (plant material Tat 1020) on leaves.

Remarks. The larvae of this species can be easily distinguished from the other known alticine larvae by club-shaped setae on dorsal tubercles.

4. *Altica litigata* Fall, 1910 (Fig. 4)

Body slightly convexed. Head, tubercles, anal plate sclerotized, spiracle and legs slightly sclerotized.

Head. Hypognathous, rounded; strongly sclerotized; epicranial suture well developed, V-shaped;

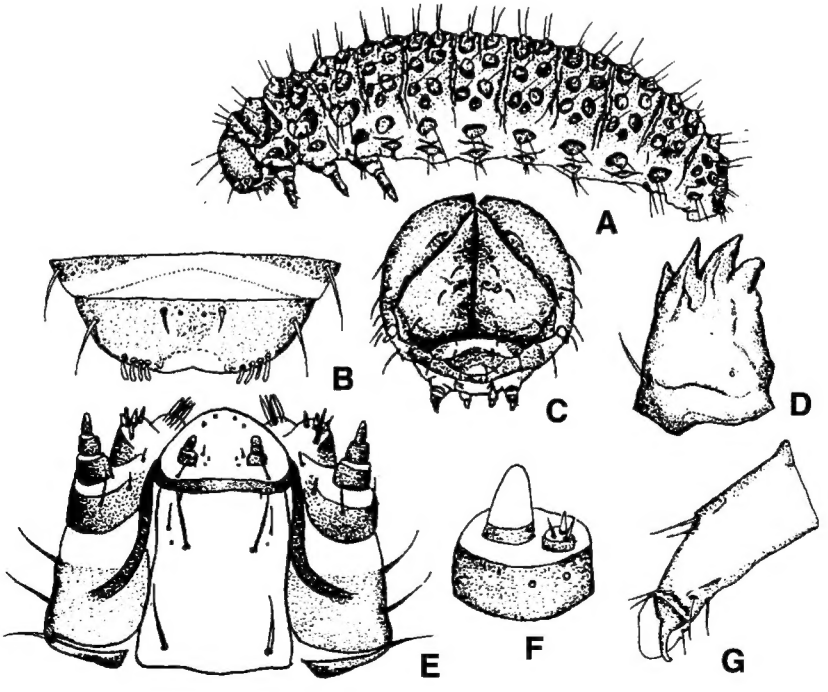

Fig. 4. *Altica litigata*. A, mature larva; B, clypeus, labrum and epipharynx; C, head; D, mandible; E, lower mouth parts; F, antenna; G, leg.

hind corners of epicranium slightly produced posteriorly. Coronal suture absent; frontal suture moderately divergent (40°), slightly curved at middle. Stemmata present. Epicranial region; 5 pairs of developed dorsoepicranial setae and 2 pairs of lateral setae. Frons subtriangular, with 4 pairs of frontal setae; endocarina distinct for full length; epistomal suture developed. Antenna 2-segmented; segment 1 with 2 sensilla, a conical sensory papilla, segment 2 with 2 spiniform setae and a conical sensory papilla. Clypeus trapeziform, with 1 pair of clypeal setae and 3 pairs of sensilla; labrum slightly rounded at anterior, with 2 pairs of labral setae and 1 pair of sensilla. Epipharynx with 4 pairs of spine-like setae. Mandible asymmetrical palmate form, 5 distal teeth, 1 mandibular seta and 1 sensilla; penicillus absent. Maxillary palp 3 segmented; palpifer with 4 setae; stipes with 2 setae. Galea with 5 setae; lacinia with 4 setae; cardo with 1 seta. Labial palp 2-segmented. Prementum with 2 pairs of setae and 4 pairs of sensilla; postmentum with 4 pairs of setae and 1 pair sensilla.

Thorax. Pronotum strongly sclerotized, with 8 pairs of setae and 3 pairs of sensilla. Thoracic spiracles rounded. Legs sclerotized, tibia with 6 setae, claw with 1 seta, pulvillus present.

Abdomen. Ten-segmented. Abdominal spiracles present on segments 1-8 similar to mesothoracic spiracles but smaller. Anal plate with 6 paris of setae.

Body length : 5.2 mm (n = 5). Head width : 0.8 mm (n = 5).

Material examined. Brownsville Tex. H.S.B 7 Mar. 1945, larva collected on *Oenothera* sp.

Remarks. The larvae of this species are characterized by the following characters: frons with 4 pairs of frontal setae, and clypeus with 3 pairs of clypeal sensilla.

5. *Altica potentillae* Brown, 1946 (Fig. 5)

Body sightly convexed, C-shaped. Head, tubercles, anal plate strongly sclerotized, spiracle and legs somewhat sclerotized; club-shaped setae on tergum except anal plate. Defensive grands absent.

Head. Hypognathous, rounded, strongly sclerotized; epicranial suture well developed. Hind corners of epicranium somewhat produced posteriorly. Epicranial suture V-shaped; coronal suture absent; frontal suture moderately divergent (35°), slightly curved at lateral. Stemmata present. Epicranium with 5 pairs of setae. Frons subtriangular, with 4 pairs of setae; endocarina distinct for full length; epistomal suture developed. Antenna 2-segmented; segment 1 with 5 pairs setae and 2 sensilla, a conical sensory papilla, segment 2 with 3 spiniform setae. Clypeus trapeziform, with 2 pairs of setae and 1 pair of sensilla. Labrum slightly notched at anterior, with 2 pairs of setae and 1 pair of sensilla. Epipharynx with 5 pairs of spiniform setae. Mandible asymmetrical gouge form, 4 distal teeth, 2 mandibular setae and 1 sensilla; penicillus present. Maxillary palp 3 segmented; palpifer with 2 setae; stipes with 2 setae and 1 sensilla; galea with 5 setae; lacinia with 6 setae; cardo with 1 seta. Labial palp 2-segmented. Prementum with 2 pairs of setae and 2 pairs of sensilla; postmentum with 8 setaeand 1 pair sensilla.

Thorax. Pronotum strongly sclerotized, with 8 pairs setae and 2 pairs of sensilla. Thoracic spiracles rounded, uniforous. Legs sclerotized; tibia with 4 setae, claw awl-shaped, with 1 seta; pulvillus present.

Abdomen. Ten-segmented; abdominal spiracles well developed, on segment 1-8 similar to mesothoracic spiracles. Anal plate with 5 pairs of setae.

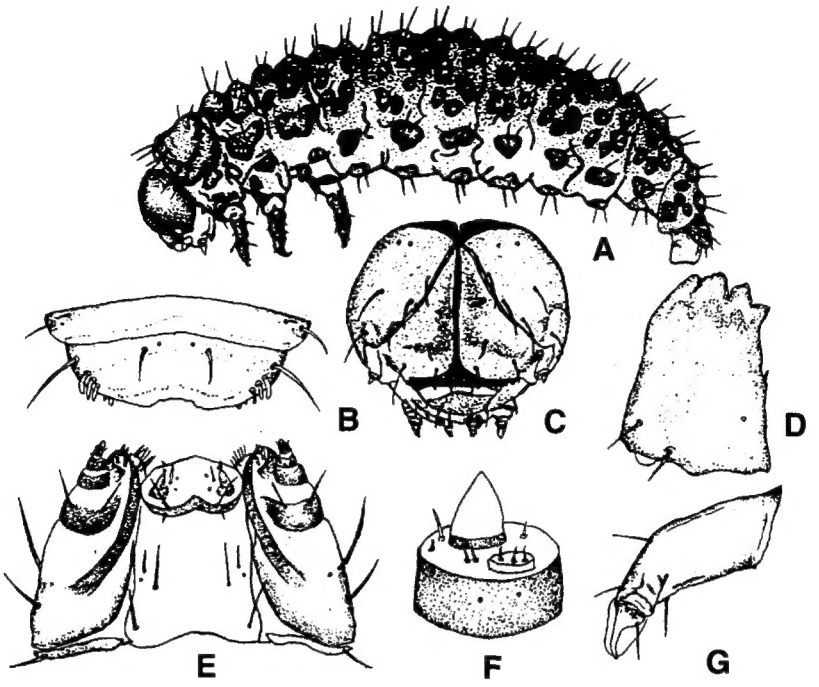

Fig. 5. *Altica potentillae*. A, mature larva; B, clypeus, labrum and epipharynx; C, head; D, mandible; E, lower mouth parts; F, antenna; G, leg.

Body length : 8.0 mm (n = 5). Head width : 0.8 mm (n = 5).

Material examined. Yamaska, Que. 27 Aug. 1945, larva and adult collected on *Potentilla anserina* by W. J. Brown.

Remarks. The larvae of this species are easily separable from the other known species by the following characters: mandibular asymmetrical gouge form; and penicillus composed by 1 seta.

6. *Altica sylvia* Molloch, 1919 (Fig. 6)

Body dark brown, almost black in appearance, sightly convexed, c-shaped. Head, tubercles, anal plate sclerotized; legs slightly sclerotized.

Head. Hypognathous, rounded, sclerotized; epicranial suture well developed. Hind corners of epicranium somewhat produced posteriorly; coronal suture absent; frontal suture slightly curved at the middle. Stemmata absent. Epicranium with 5 pairs of setae and 3 pairs of sensilla. Frons subtriangular, with 3 pairs of setae; endocarina distinct for full length; epistomal suture developed. Antenna 2-segmented; segment 1 with 3 setae and 2 sensilla, with a enlarged conical sensory papilla; segment 2 with 4 setae. Clypeus trapeziform, well developed, with 3 pairs of setae. Labrum notched at anterior margin, with 2 pairs of setae and 1 pair of sensilla. Epipharynx with 4 pairs spine-like setae. Mandible asymmetrical gouge form, with 5 distal teeth, 2 mandibular setae and 2 sensilla; penicillus present. Maxillary palp 3 segmented; stipes with 3 setae; galea with 5 setae; lacinia with 5 setae; cardo large, with 1 seta. Labial palp 2-segmented. Prementum with 8

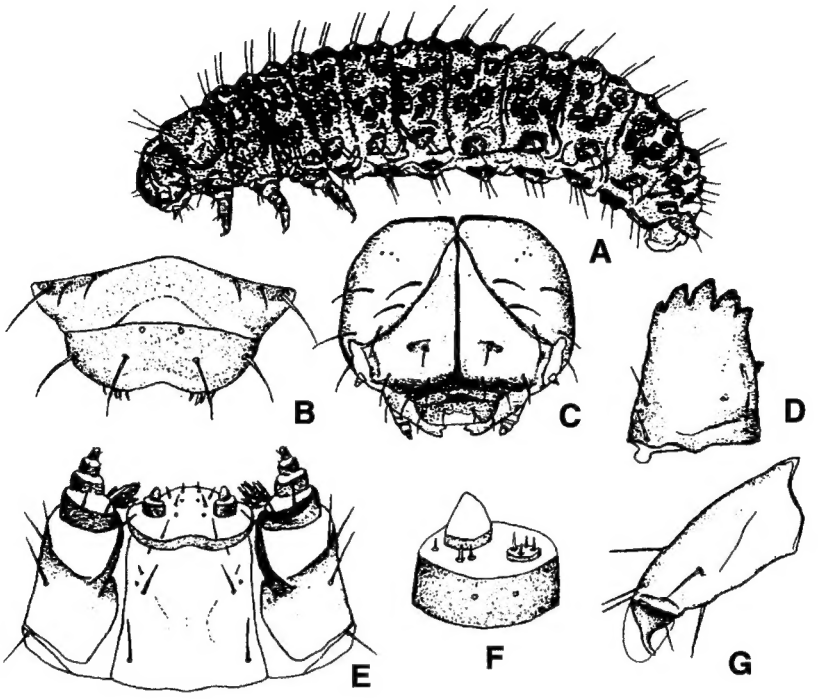

Fig. 6. *Altica sylvia*. A, mature larva; B, clypeus, labrum and epipharynx; C, head; D, mandible; E, lower mouth parts; F, antenna; G, leg.

spine-like setae, with 4 sensilla; postmentum with 8 setae and 1 pair of sensilla.

Thorax. Pronotum strongly sclerotized, with 8 pairs setae and 3 pairs sensilla. Thorcic spiracles rounded, uniforous. Legs rather long and slender, tibia with 5 setae, claw falciform, with 1 seta; pulvillus bladder-like.

Abdomen. Tensegmented; abdominal spiracles present on segment 1-8 similar to mesothoracic spiracles but smaller. Anal plate with 5 paris setae.

Body length : 9.6 mm (n = 5). Head width : 0.8 mm (n = 5).

Material examined. Granville. Mass. 5 June 1950, larvae collected on blueberries by John Weidhass.

Remarks. The larvae of this species are easily separable from the other known species by the following characters: mandible with 2 mandibular setae and 2 sensilla; and anal plate with 5 pairs of setae (one pair of them club-shaped setae).

7. *Altica torquata* Leconte, 1858 (Fig. 7)

Body sightly convexed, c-shaped, slightly slender and long. Head, tubercles, anal plate sclerotized; dorsal tubercle with club-shaped setae. Legs slightly strongly sclerotized.

Head. Hypognathous, rounded, sclerotized; epicranial suture well developed, V-shaped, hind corners of epicranium slightly produced posteriorly; coronal suture absent; frontal suture broadly divergent nearly straight. Stemmata absent. Epicranium with 5 pairs of setae and 3 pairs of

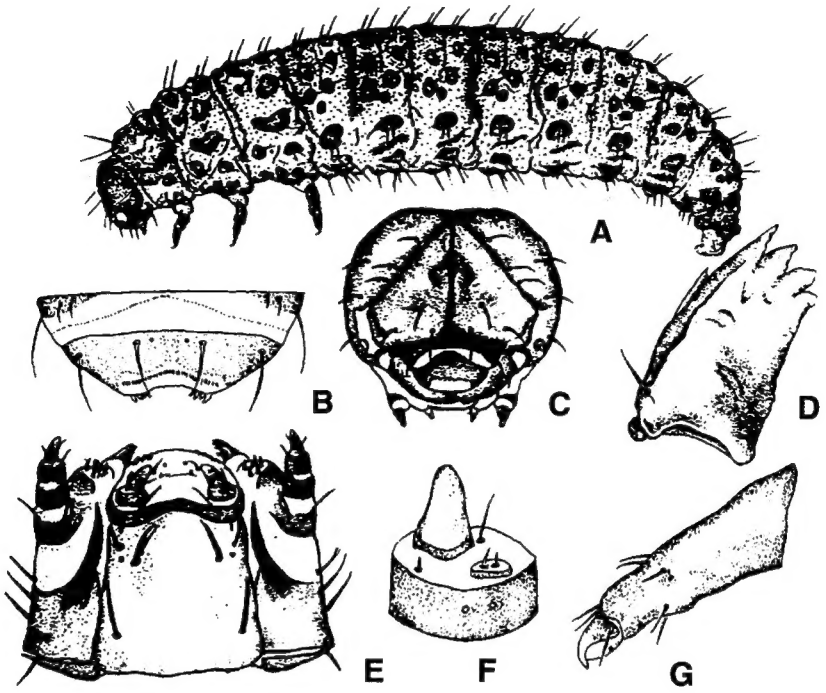

Fig. 7. *Altica torquata*. A, mature larva; B, clypeus, labrum and epipharynx; C, head; D, mandible; E, lower mouth parts; F, antenna; G, leg.

sensilla. Frons subtriangular, with 3 pairs of setae; endocarina distinct for full length; epistomal suture developed. Antenna 2-segmented; segment 1 with 2 setae and 2 sensilla, with a large conical sensory papilla; segment 2 with 2 setae. Clypeus trapeziform, well developed, with 3 pairs of setae (1 pair very strongly developed). Labrum notched at anterior, with 2 pairs of setae and 1 pair of sensilla. Epipharynx with 4 pairs of spine-like setae and densely microseta. Mandible asymmetrical palmate form, with 5 distal teeth, with 1 mandibular seta; penicillus absent. Maxillary palp 3-segmented; stipes with 3 setae; galea with 5 setae; lacinia with 4 setae; cardo with 1 seta. Labial palp 2-segmented, segment 1 with 1 seta. Prementum with 2 pairs of setae, with 2 pairs of sensilla; postmentum with 4 pairs of setae and 1 pair of sensilla.

Thorax. Pronotum strongly sclerotized, with 8 pairs of setae and 2 pairs of sensilla. Thoracic spiracles rounded, uniforous. Tibia with 7 setae; claw falciform, with 1 seta; pulvillus bladder-like.

Abdomen. Ten-segmented; abdominal spiracles present on segments 1-8 similar to mesothoracic spiracles but smaller. Anal plate with 5 paris of setae. Pygopod well developed.

Body length : 8.0 mm (n = 5). Head width : 0.8 mm (n = 5).

Material examined. H.S.B. 31 March 1941, larvae collected desert plants near Calexico.

Remarks. The larvae of this species are characterized by club-shaped setae only on anal plate.

8. *Altica ulmi* Woods, 1918 (Fig. 8)

Body sightly convexed, slender and long. Head, tubercles, anal plate sclerotized. Dorsal tubercle

with club-shaped setae. Legs slightly sclerotized.

Head. Hypognathous, rounded, sclerotized; epicranial suture well developed. Hind corners of epicranium slightly produced posteriorly; coronal suture very short; frontal suture slightly curved at the lateral. Stemmata absent. Epicranium with 4 pairs of setae and 1 pair of sensilla. Frons subtriangular, strongly scleotized, with 3 pairs of setae; endocarina distinct for full length; epistomal suture well developed. Antenna 2-segmented; segment 1 with a large conical sensory papilla; segment 2 with 4 setae. Clypeus trapeziform, well developed, with 2 pairs of setae and 2 pairs of sensilla. Labrum slightly notched at anterior, with 3 pairs of setae and 1 pair of sensilla. Epipharynx with 5 pairs of setae. Mandible asymmetrical palmate form, with 5 distal teeth, with 2 mandibular setae and 1 sensilla; penicillus present. Maxillary palp 3 segmented; stipes with 2 setae, with 1 pair sensilla; galea with 6 setae; lacinia with 6 setae; cardo with 1 seta. Labial palp 2-segmented. Prementum with 1 pairs of setae and 3 pairs of sensilla; postmentum with 4 pairs of setae and 1 pair of sensilla.

Thorax. Pronotum strongly sclerotized, with 8 pairs of setae, with 2 pairs of sensilla. Thoracic spiracles rounded, uniforous. Legs rather long and slender, tibia with 5 setae, claw falciform, with 1 seta; pulvillus bladder-like.

Abdomen. Ten segmented; abdominal spiracles present on segment 1-8 similar to mesothoracic spiracles but smaller. Anal plate with 5 paris of setae.

Body length : 6.0 mm (n = 5). Head width : 0.8 mm (n = 5).

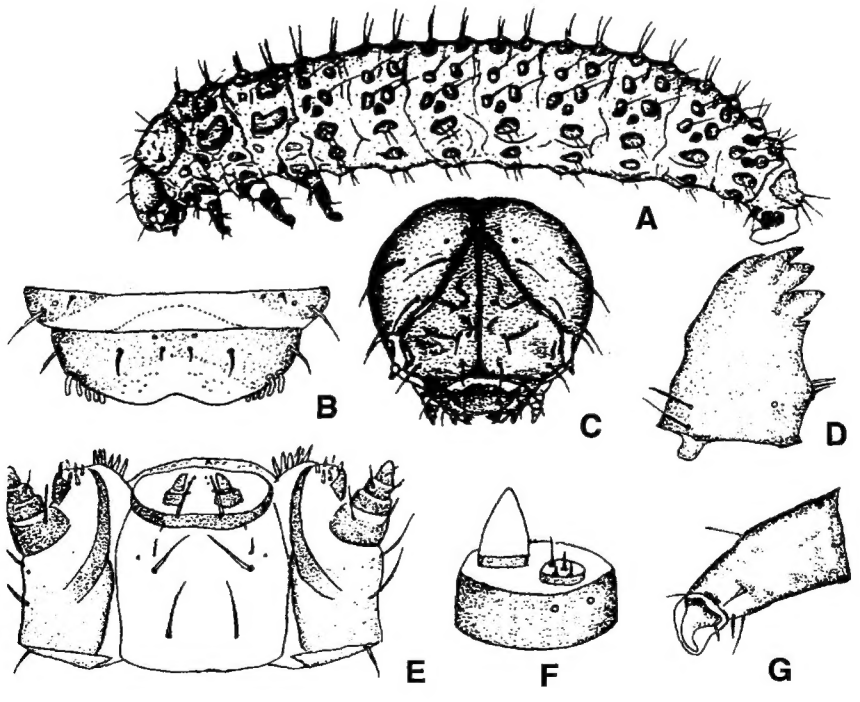

Fig. 8. *Altica ulmi*. A, mature larva; B, clypeus, labrum and epipharynx; C, head; D, mandible; E, lower mouth parts; F, antenna; G, leg.

Material examined. Norreared, New York, 12 Aug. 1943, larvae collected on leaves of *Elm* sp by Boving.

Remarks. The larvae of this species are easily separable from the other known species by following characters: labrum with 3 pairs of labral setae, and well developed penicillus on mandibles.

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요 약

북미산 *Altica*속 8종 (*Altica ambiens alni, A. bimarginata, A. brisleyi, A. litigata, A. potentillae, A. sylvia, A. torquata* and *A. ulmi*) 유충에 대한 연구로서, 이들 북미산 유충은 처음 기재된다. 또한 이들 유충의 검색표 및 분류학적 소견도 언급한다.